REGISTERED No. D. 221.

The Gazette of India

EXTRAORDINARY

PART II—Section 3

PUBLISHED BY AUTHORITY

No. 57] NEW DELHI, SATURDAY, FEBRUARY 8, 1958/MAGHA 19, 1879

MINISTRY OF RAILWAYS

(Railway Board)

RESOLUTION

New Delhi, the 8th February, 1958

S.R.O. 516.—In continuation of Notification No. E(AO)57API/9 dated 29th November, 1957, published in Part II, Section 3 of the Government of India Gazette Extraordinary dated 29th November, 1957, the Government have received the Report submitted by the Commission of Inquiry under the Chairmanship of Shri G. D. Khosla, a Judge of the Punjab High Court on the causes of accident to Train No. 1 Down Bombay-Calcutta Mail at Mile 97/5 between Padali and Asvali stations on the Igatpuri-Bhusaval double line section of the Central Railway at 22·45 hours on the 23rd November, 1957 and hereby publish it for general information. The Government have accepted the Commission's finding that the derailment of 1 Down Bombay-Calcutta Mail on 23rd November, 1957 was 'the result of a deliberate act of sabotage committed by some person or persons unknown.'

The suggestions made by the Commission in items 2 (a), (b), (d) and (f) of the summary of conclusions in the penultimate paragraph of its report are already the general policy, in principle, and action on item (c) has also been initiated. The Government will after due consideration also take any further action which may be necessary on these and on the other suggestions and various other matters brought out in the Report.

INTRODUCTORY

The 1 Down Bombay-Calcutta Mail which left Bombay on the evening of 23rd November, 1957, met with an accident at 22.48 hours when it reached Mile 97/5 between Padali and Asvali railway stations on the Igatpuri-Bhusaval Double Line section of the Central Railway. The surrounding terrain at this place is undulating and the railway track lies over an embankment which is nearly 30 feet high from the natural ground level. The single-line down track at this mileage is on a right hand curve of 2,409 feet radius on a falling gradient of 1 in 100. The up track. *i.e.* the track on which the trains to Bombay travel, is at a distance of nearly 600 feet from the down track. The two tracks (Up and Down) run close and parallel to each other over the greater part of the section but with a view to obtain an easier grade over the up line, it was found more convenient to bifurcate the tracks over certain portions.

The 1 Down Mail consisted of 11 bogies hauled by a WP Locomotive. The engine and the first 8 bogies were derailed. Of the derailed coaches, four bogies, namely the 2nd, 3rd, 4th and 5th fell down the embankment and capsized. The third bogie was completely smashed and 8 of its occupants were killed. One of the passengers in the 5th bogie also received fatal injuries. There were 16 cases of serious injuries, 38 of minor injuries and 53 of trivial injuries.

The Government of India announced that a Commission of Inquiry would be set up to enquire into the causes of this accident, and on 29th November 1957, the following notification was issued by the Ministry of Railways:—

"Whereas the Central Government is of opinion that it is necessary to appoint a Commission of Inquiry for the purpose of making an inquiry into the causes of the accident to Train No. 1 Down Bombay-Calcutta Mail at Mile 97/4 between Padali and Asvali stations on the Igatpuri-Bhusawal double-line section of the Central Railway at 22.45 hours on 23rd November 1957:

Now, therefore, in exercise of the powers conferred by Section 3 of the Commisions of Inquiry Act 1952 (60 of 1952) the Central Government hereby appoints a Commission of Inquiry consisting of—

(i) Justice G. D. Khosla, I.C.S. a Judge of the Punjab High Court.—*Chairman.*

Members

(ii) Dr. P. Subbarayan, M.P.

(iii) Shri J. N. Nanda, Retired General Manager, of Ex. Nizam State Railway.

2. The said Commission shall—

(i) make an inquiry into the causes of the said accident and for that purpose take such evidence as may be necessary;

(ii) state its findings as to causes of the said accident and as to the person or persons if any, responsible therefor;

and

(iii) suggest safeguards against similar accidents in future.

3. The said Commission shall submit its report to the Central Government within a period of one month from the date on which it commences its inquiry."

The Commission had a preliminary discussion at Delhi on December 5th and spent the next few days in studying the evidence recorded by the Government Inspector of Railways in the course of his inquiry under Sections 83 & 84 of the Indian Railways Act and rules made thereunder. The Government Inspector of Railways had commenced his inquiry on 24th November but he suspended it as soon as the appointment of the present Commission was announced (*vide* Ministry of Railways Notification No. S.R.O. 431 dated 30th January 1957). The Commission examined two witnesses who were available at Delhi and laid down the procedure of the Inquiry. The Commission then proceeded to Devlali and on December 17, the site where the accident took place was inspected. The Commission also saw the condition of the bogies, rails, sleepers, fish-plates, bolts, nuts, etc. They examined the engine and the various exhibits which had been taken to Nasik and to which a fuller reference will be made in the course of this Report. Regular sittings at Devlali stated on December 18 and continued till December 24, when 49 witnesses were examined including some who had already been examined by the Government Inspector of Railways. The Commission carried out tests at Nasik on anti-sabotage devices pertaining to the track and also conducted experiments over the Igatpuri-Devlali Section with headlights fitted to an engine of the type which was used to haul the train in question. The results of these Tests are appended hereto as Annexures 'A' & 'B'. On return to Delhi, the Commission inspected the welded track on the approach of Yamuna Bridge and tested the efficacy of non-removal keys used on four-keyed steel sleepers fitted with loose jaws. The nature of these experiments and the conclusions drawn therefrom will be discussed in the course of this Report. The Inquiry was continued at Delhi and four more witnesses were examined on 8th and 15th January. The Commission is now in a position to draw up its Report and submit it to Government.

I. THE CAUSE OF THE ACCIDENT

The first part of the Commission's task has been comparatively easy and free from doubts and anxieties. The Commission have unanimously reached the conclusion that the accident under inquiry was the result of a deliberate act of sabotage committed by some person or persons unknown. The Commission is satisfied beyond any shadow of doubt that a complete rail measuring 42 feet was removed from the track and the resulting discontinuity in the alignment caused the derailment which entailed loss of life and property.

The train left Bombay punctually at 19.10 hours. From Bombay to Igatpuri (a distance of 85 miles) the train was electrically hauled. It arrived Igatpuri at 22.12 hours, 17 minutes late. Engine No. 7538 of the WP type manned by Driver Bentley was attached to haul the train beyond Igatpuri.

The train consisted of an engine and 11 bogies and its total load was 494 tons. The maximum number of bogies for Express and Mail trains hauled by WP engines is 12. Therefore, the length of the train was in no way abnormal; the load, too, was not excessive. The train left Igatpuri at 22.27 hours, 17 minutes late, and passed Padali (Mile 95/12) at 22.44 hours. A little less than two miles beyond Padali, the accident took place at Mile 97/5.

According to Driver Bentley, who was in charge of the engine, a severe shock was felt at the point of derailment 27 feet ahead of Telegraph Post 97/5. Bentley immediately applied the vacuum brake and the derailed engine came to a stop between Telegraph Posts 97/7 and 97/8 after travelling a distance of about 200 yards. The engine had travelled partly over the rails and partly over the ballast smashing the CST 9 plate sleepers. Driver Bentley saw, on getting down from the engine, that the bogie wheels were completely off the rails whereas all the coupled wheels as also the radial wheels were on the rails. The leading wheels of the engine bogie had derailed to the right and the trailing wheels to the left. The wheels of the engine-tender were all derailed to the left of the track. The engine bogie wheels were thus straddling the rails and it was probably this circumstance which held the engine on the formation and prevented it from going completely off the track and rolling down the embankment, as bogies Nos. 2 to 5 in fact did.

The bogie immediately behind the engine was derailed to the left and remained standing, though tilted, on the formation. The coupling between the first and the second bogie was wrenched off and the 2nd, 3rd, 4th and 5th bogies ran completely off the formation and precipitated down the embankment. The third bogie lay bottom up and was com-

pletely smashed. The 6th bogie was derailed to the left but stood on the formation at an inclination. The 7th and 8th bogies were derailed to the left (the 8th partially) and both of them remained standing on the formation at an angle. The 9th, 10th and 11th bogies remained on the rails. The train, therefore, lay in three different sections: (i) the engine and the first bogie resting on the formation, (ii) the 2nd, 3rd, 4th and 5th bogies lying capsized at the bottom of the embankment, and, (iii) the remaining bogies on the formation, the last three being on the rails.

At this stage, it is convenient to describe briefly the structure of the Railway track at this mileage. The track consists of a levelled formation over which rails and sleepers are laid. The rails are fixed to sleepers which may be wooden, iron or steel. In the present case, the sleepers were what are known as CST-9 plate sleepers made of cast iron. There were 20 such sleepers to each rail. The rails used were F.F.R.B.S. (Flat Footed Revised British Standard) type each 42 feet in length and weighing 90 lbs per yard. In this type of track, the rails are seated in the jaws of CST-9 plates and are fixed by wedge-like keys which fit between the rail and the jaws of the CST-9 plates. The keys, when hammered home, holds the base of the rail firmly to the sleeper. Consecutive rails are jointed by means of two fish-plates which are placed, one on either side at the joint, and fastened to the rails and to each other by means of four bolts and nuts. When the keys are driven home and the nuts tightened, the track is firm and rigid and the rails cannot be moved laterally. The track is laid on stone ballast which has the effect of stabilising it, acting as a shock-absorber, and distributing the load on the formation. To remove a rail, all that is required is to unscrew the eight bolts on two consecutive joints and hammer out 20 keys. The rail is then free of the CST-9 plates and can be prized up and levered away from the track.

Experiments performed in the presence of the Commission showed that the entire operation of disconnecting one rail and rolling it over to a distance of about 20 inches takes only a few minutes. Four unskilled labourers were able to remove a rail in 3 minutes and 2 seconds. The removal of keys and unfastening the rail joints took 1 minute 45 seconds and displacing the rail by levering it 15 inches to 18 inches from its normal alignment took 1 minute & 17 seconds. A gang of skilled labourers accustomed to performing this operation would take less time. To remove a rail at night time without the assistance of a light would naturally take longer but gangmen accustomed to working on the line and handling the few tools required for their purpose would find no difficulty in carrying out the task in the space of a few minutes.

It has already been stated that the track at the site runs over a high embankment on a right hand curve. It may be mentioned in addition that there is an arch-culvert of 5 feet span at the spot, and stone steps lead down the slope from the top to the bottom of the embankment. The

derailment took place only a few feet from these steps. A person working on the track and engaged in removing a rail could run down the steps and conceal himself inside the barrel of the culvert in less than a minute. The point of derailment is at the highest point of the embankment and on a right hand curve. It is necessary to draw attention to these circumstances, because they go to show that the saboteurs took pains to choose a suitable sport for committing this offence, after observing and taking stock of the facilities it provided for immediate concealment and also because it was a place where a derailment would cause the maximum amount of damage.

The position of the derailed carriages and the condition of the track were examined immediately after the accident by some of the train staff and a number of passengers who had alighted from their carriages. They saw that a complete rail had been removed from the sleepers and it lay under the 7th and 8th bogies, parallel to its original position and at a distance of about 20 inches. The fish-plates, nuts and bolts relating to the two joints of this rail were lying disjointed and at the spot but undamaged. The displaced rail appeared to be completely undamaged. When the bogies were subsequently lifted and the rail examined closely, it was found that it was wholly intact and had not been subjected to any kind of pressure or impact. Immediately after the accident the rail lay pressed under the footboards of the 8th bogie. The condition of the rail immediately preceding the displaced rail was also examined, and it was seen that there was a slight flattening of the top or table of this rail at the fore or Bhusawal end and a small lip or burr had been formed. The near or Bombay end of the rail following the displaced rail was badly bent in a vertical plane. The distortion can be seen very clearly in Photograph No. 14 of the series taken under the instructions of the Government Inspector of Railways on the morning of the 24th. Photographs Nos. 1 to 22 are appended hereto as Annexure 'C'. The witnesses who saw the rail immediately after the accident were shown photograph No. 14 and they all agreed that it showed correctly the damage which had been noticed by them at the spot. The succeeding 8 rails had also been displaced from their original position. The fish-plates, bolts and nuts which had held these rails in position were damaged and in some cases wrenched off completely. The position of the various rails after the accident can be seen in the plan prepared under the personal supervision of the Divisional Engineer, Bhusawal. Some of the rails can also be seen in Photographs Nos. 1, 2 and 3.

The rails, fish-plates, bolts, nuts, keys and CST-9 plates were personally numbered and marked in white paint by the Divisional Engineer, Bhusawal, who arrived at the scene soon after the accident, and it will be convenient to refer to the various exhibits by these numbers. The

displaced rail was marked L-3, the rails preceding it on the Bombay side were marked L-2 and L-1, and the rails following it were marked L-4, L-5, L-6, etc. respectively.

An examination of the engine wheels conducted subsequently showed a dent mark on the tyre of the left leading bogie-wheel and a similar but less-pronounced mark on the tyre of the left leading coupled wheel. These dents were obviously caused by the impact of the end of the rail L-4 on the wheels as the engine after slipping off the rail L-2 and travelling across the gap hit the rail L-4 with considerable force. The displacement of the other rails was caused by the continued hammering blows of the bogies wheels which followed the derailed engine. The rails thus subjected to these impact buckled and were wrenched off their original position. The left hand rails of the track being thus displaced, 8 bogies were derailed and 4 of them rolled down the embankment and capsized.

These facts are deposed to by all the witnesses who saw the scene of the accident on the night of the occurrence and on the following morning. Perhaps the most important of these witnesses is Mr. Ahuja (Witness No. 15) if only because he was the first person who observed the condition of the track after the accident. He was a passenger in the 8th bogie which was resting upon the displaced rail. He came out of his compartment the moment the train stopped, and within 5 minutes he examined the rails under his bogie. He had only a step or two to walk. It was the most natural thing for him to look under the bogie because a passenger involved in a railway accident will try to find out the cause. The first thing he will see is the condition of the track. This is exactly what Mr. Ahuja did. He said that he borrowed a torch from a passer-by and with the light of the torch saw the loose rail lying under the two bogies. He went on to say:

> "With the torch from a passer-by I made a close examination of the track and noticed that exactly under my compartment the rail joint was opened, with a fish-plate, nuts and bolts and the key all lying on the ballast. I particularly noticed that the bolts and nuts were not broken or damaged. In fact the oil marks on the bolts indicated as if they had been taken out carefully and not broken by a sudden hit or accident."

The next witness to see the displaced rail was Mr. S. C. Banerjee, Managing Director of the Hindustan Construction Company. He was travelling in the air-conditioned coach which was the 6th bogie from the engine. He has some experience of Permanent Way and Works having gathered it during the early part of his career. He says that he got down from his train immediately after the occurrence, and seeing that the accident had taken place on a curve, he thought that the derailment might be due to defective superelevation. He spoke about the matter to

the engine driver, but the driver told him to look under the carriages and handed him his lamp. The witness went on to say:

> "I took his lamp and tried to see the bolts and nuts because I felt that these were smashed and the joint might have been broken. So I took the light and put my head underneath the coach and could see one fish-plate lying at right angles to the rail and a few bolts."

When questioned, he said:

> "It was sabotage. What else can it be? The joints were opened by somebody. I am very sure about it. I have seen that the bolts were untouched".

Mr. Bhagat, General Manager, Hindustan Steel (Private) Ltd., (Witness No. 14) stated that he saw a fish-plate lying loose on the track two carriages away from the air-conditioned coach. At this place he could see no rail at all on the track. Mr. Bhagat's statement bears out the story of Mr. Ahuja and Mr. Banerjee that the rail L-3 had been deliberately displaced. Driver Bentley (Witness No. 4) and Guard Choksi (Witness No. 5) saw the displaced rail, fish-plates, bolts, etc. within an hour of the accident. Bentley's evidence in this respect is important. He is an experienced driver of many years standing. He became a driver in 1929 and has been driving Mail and Express trains since 1948. The engine hauling this train had been allotted to him and he had driven it for over 70 per cent of its total run. The promptness with which he applied the vacuum brakes speaks of his presence of mind. No one could be more anxious than he to discover the cause of this accident. He says:

> "I immediately went to ascertain the cause and there I found at Telegraph Post No. 5, a fish-plate lying and the bolts and nuts separated.....I saw the fish-plates about 45 minutes after the accident, while going towards the Gaurd's brake on the right-hand side of the track by the light of my torch. Then I went under the bogie to see the removed fish-plate in greater detail. There I found the fish-plate lying, bolts lying naked without the nuts. There I met three or four gentlemen from the air-conditioned coach who asked me who I was and followed me being inquisitive. I showed them the fish-plates, bolts and nuts which were lying near that open joint".

In addition to the evidence of the crew and passengers, we have the very important evidence of Brigadier Sathe (Witness No. 1) and Lt. Col. Barry-Jackson (Witness No. 2) who arrived at the spot at about 1·15 A.M. from Devlali on receiving information of the accident. Both of them examined the condition of the rails and bogies and they have stated that they found the rail L-3 lying undamaged at some distance

from its original position. The fish-plates, bolts and nuts of the two end joints of this rail were lying intact and undamaged just as they had been removed. They also saw the condition of the Bhusaval end of the rail L-2 and of the Bombay end of the rail L-4. Brigadier Sathe said:

> "The rail in question (L-3) was completely intact and there were no marks of shearing of the fish-plates or bolts and nuts. The bolts were also intact and were lying near the rail. The fish-plates in question were also intact. The rail next to the one that was removed was dented right in the centre, obiously the marks of the first bogie wheel of the engine striking it. This rail was also bent as the other wheels went over it."

The above statement was made by the witness in the course of the inquiry by the Government Inspector of Railways. The statement was read out to him and he admitted its correctness. It, therefore, forms part of the Commission's record of evidence. The statement of Lt. Col. Barry-Jackson is substantially the same. In fact, he saw the displaced rail even before Brigadier Sathe did, noticing it sometime between 1-30 and 1-45 A. M. He stated before the Commission that the running board of the Bhusaval end of the 8th bogie was resting tightly on the displaced rail.

In addition to these witnesses, a number of other persons also arrived at the spot from various quarters on receiving information of the accident. Assistant Superintendent of Police, Ribeiro (Witness No. 34) saw the track at 3 A.M. Permanent Way Inspector, Kankate (Witness No. 32) reached the spot at 00-45 hours. Deputy Chief Engineer, Malvankar, (Witness No. 36) reached the site at 5-20 hours on the 24th. Shri Dasai, Government Inspector of Railways, arrived at 10-30 A.M. All these witnesses have corroborated the story of the persons who saw the track immediately after the accident. There is no reason whatsoever to doubt the evidence of any of these witnesses in so far as it relates to the condition of the rails, engine, bogies, etc. The Commission were, in particular, impressed by the evidence of Brigadier Sathe, Lt. Col. Barry-Jackson, Mr. Ahuja and Mr. Banerjee. These persons saw the displaced rail lying under the footboards of the 7th and 8th bogies immediately after the accident. They had specially directed their attention to the probable cause of the accident and had, therefore, expressly examined the place where the derailment began. There is no rebuttal of any kind and no suggestion was made at any stage of the inquiry that these witnesses were in any way interested or that their observation was defective. They had no motive whatsoever in attempting to put forward a false story regarding the cause of the accident. The Commission have, therefore, no hesitation whatsoever in accepting their testimony. The evidence of Driver Bentley is also completely reliable and there is no reason why it should not be acted upon.

The sum total of this evidence may be stated as follows:—

(i) *Condition of the rail L-3 immediately after the accident:*— The rail was completely undamaged and was lying on its side at a distance of about 20 inches from its original position, with its head or table facing the track. It was almost exactly parallel to its original position. The foot-boards of one of the bogies were resting on the rail and it was not possible to move it without lifting the bogie.

(ii) The fish-plates, bolts and nuts at each of the two ends of rail L-3 were lying undamaged. This showed that the two sets of fish-plates corresponding to the two joints of L-3 with L-2 and L-4 respectively had been deliberately unscrewed and not forced out by the pressure of wheels.

(iii) *Condition of the rail L-2, i.e. the rail immediately preceding the displaced rail.*—There was a slight depression of the rail-table at the end of this rail and the forcing out of the metal had caused a small lip or burr to form at this place. The depression and the lip are clearly visible in photographs Nos. 10 & 11. (The witnesses have all stated that these photographs correctly show the state of the rail L-2 as it was seen at the spot).

(iv) *Condition of rail L-4, i.e. the rail following the displaced rail.*—The near end of this rail was badly bent as if it had been beaten down repeatedly with a very heavy hammer. The holes for the bolts which hold the fish-plates were distorted. This showed that the distortion took place when there were no bolts in position. The distortion and the bending of the rail are seen clearly in Photographs Nos. 14 & 15. (The witnesses have all stated that these Photographs correspond to the exact condition of the rail L-4 as they saw it at the spot.)

(v) There was damage to the engine wheels. The left leading bogie wheel had a dent on its tyre and this dent corresponded exactly in size and shape to the head of a rail of the size used in the track at the spot. The left leading coupled wheel also had a similar dent, though this was a little less pronounced. It is clear that the engine wheels hit the end of the rail L-4 and received these dents.

(vi) The CST-9 plate sleepers were all crushed except for the first one immediately following the rail L-2. This one had only a slight dent on it. This state of affairs was consistent with the carriage wheels having jumped off the rail L-2 and landed just beyond the first CST-9 plate. The wheels then travelled over the sleepers and smashed the CST-9 plates.

(vii) The point where the rail L-3 was displaced lies at the highest point of the embankment. It is almost at the middle of a

right-hand curve where an outward thrust due to centrifugal force is expected. The rail L-3 is the left-hand rail and was, therefore, on the outside of the curve. A train going round a right-hand curve is subject to a lateral force towards the left and the pressure of the rail on the wheel flange keeps the wheel on the track. Therefore, the maximum damage is more likely to be caused by the removal of the left rail than by the removal of the right rail. As pointed out earlier, there is a 30 feet drop down a steep embankment at this place. A few feet from the point of derailment, there is a culvert and stone steps lead down from the top to the bottom of the embankment. These circumstances make it easy for a sabotenur to run down the steps quickly and conceal himself if there is danger of discovery.

From these facts one and only one conclusion is possible, namely some one deliberately removed the rail L-3 shortly before the accident. The track was intact during the whole of that day and in fact till one and a half hours before the accident. There is evidence to show that no less than four trains passed on the down track and the point where the accident took place after 19 hours. The last train to pass was KNE 46 Down which left Padali at 21·18 hours and reached Asvali at 21·27 hours. This train must have passed over the point 97/5 at approximately 21·21 hours. Till then the rail had not been removed. The miscreants, therefore, chose the darkness of the night for the commission of this crime.

It is quite clear that what happened was this. The engine of the 1 Down Bombay-Calcutta Mail travelling at a speed of about 45 miles per hour came to the end of the rail L-2 and the next rail not being there, it slipped off the end and travelled over the ballast. The derailment caused a sudden shock and the driver at once applied his brakes. The speed of the engine and of the train was immediately decreased but due to momentum it continued to travel for some distance. The left leading bogie-wheel of the engine on coming to the end of the gap caused by the removal of the rail L-3 hit the end of the rail L-4. This caused a dent on the tyre of the engine wheel. The left leading coupled wheel received a similar impact from the end of the rail L-4, causing a dent on the tyre of that wheel also. The engine continued to go forward partly on the rails and partly on the ballast, and came to rest at a distance of about 200 yards from the point of derailment. The first bogie remained attached to the engine but by the continuous impact of carriage wheels on the end of the rail L-4, the rails ahead buckled and were bent out of shape. Some of them were ripped off the sleepers and were thrown to a distance of several feet. It would appear that after the first bogie, the continuity of the left rail was completely broken even beyond the rail L-3. The next four bogies could not stay on the track and were thrown out by the action of the centrifugal force. They were wrenched off the fore and aft portions of the train and fell down the embankment At the same

time the vacuum brakes had been acting on all the bogies throughout the train and the 7th to 11th bogies had come to a dead stop. They, therefore, remained in an upright position. The 7th and 8th bogies were derailed but they remained on the track in a tilted position. The remaining bogies (9th, 10th and 11th) remained on the rails.

Thus only is it possible to explain the displaced position of the rail L-3, wedged under the footboards of bogie No. 8 and the undamaged condition of the rail and of all the fish-plates, nuts and bolts corresponding to the joints at its two ends. Thus only can the formation of a lip at the end of L-2, and the distortion observed at the near end of L-4, be explained. The dents on the engine wheel are only consistent with the end of a rail having hit the wheels. This was impossible unless there was a gap in the alignment and a rail end was exposed to the impact of wheels. The conclusion that the accident was caused by a deliberate act of sabotage is manifestly obvious from the above discussion. Indeed, these facts are wholly inconsistent with any other hypothesis. Expert opinion consisting of the evidence of Railway Engineers and Departmental witnesses including the Government Inspector of Railways who reached the spot soon after the accident points to the same result. These witnesses have stated in unequivocal terms that the derailment was caused by the removal of the rail L-3 and this removal was not the result of an accident but constituted an act of sabotage perpetrated before the train arrived at the spot.

To strengthen the argument further, the Central Railway produced evidence designed to show that no other cause or defect to which a derailment might possibly be attributed obtained in the present case. An accident may be caused by some defect in the engine or carriages or the improper maintenance of the rail track. Also it may follow some act of negligence or incompetence on the part of the driver. These alternatives were all examined and it was shown that no other possible cause of the accident existed.

As far as the engine is concerned, it is of a type conforming to the Indian Railways standard design which is used extensively. The Central Railway alone has 95 engines of this type. The WP type of engine is of American or Canadian manufacture and was introduced into this country in 1947. Bulk deliveries were received in 1949 and since then the engines have proved most satisfactory. There has never been any complaint of nosing or hunting against these engines. The engine which hauled this particular train was manufactured in Canada in 1956 and was put into service on 20th August 1956. It was allotted to Driver Bentley who has 27 years' experience as an engine driver. It had done 300 single trips and of these, about 70% were done by Driver Bentley. The engine had conducted itself satisfactorily throughout and apart from some minor

"bookings" and maintenance over-hauling, no repairs had been found necessary. The engine was brought from Bhusawal to Igatpuri on the morning of the 23rd by Driver Bentley. It had run satisfactorily and some minor "bookings" noted by Driver Bentley were attended to before the train left Igatpuri. The master file of the engine which contains a complete record of the Engine's history was produced before the Commission and it was seen that the engine was in good running order. The engine was also examined after the accident and no defect of any kind apart from the minor damage caused by the derailment was noticed. There is, therefore, nothing in the history of this engine to show that there was present any defect which if unattended to would cause a derailment. The evidence of Shri Kapur, Divisional Mechanical Engineer, and Shri Hydari, Deputy Chief Mechanical Engineer, and the driver, Bentley, is quite clear on this point. There is also the evidence of Shri Vaidyanathan, Assistant Mechanical Foreman, to show that all bookings for repairs were carried out.

There is nothing whatever to indicate that Driver Bentley was guilty of any negligence or incompetence. There is no evidence of excessive speed or improper application of brakes. There is no reason why the driver should have suddenly applied brakes, and in any event, the application of brakes, sudden or otherwise, cannot possibly result in derailment. The brakes were applied after the Driver felt the shock of derailment and not before. With regard to excessive speed, the evidence is that at this point the maximum speed attained by a train is 45 miles per hour. This is so in the very nature of the alignment of the track and its gradient. Bentley has run over this section of the track hundreds of times and is familiar with every inch of it. The track after Igatpuri follows a somewhat undulating course and a little after mile 94 a steep upward gradient of 1 in 110 begins. This eases to 1 in 132 till the crest is reached at point 96/12. Thereafter the track goes down-hill at a gradient of 1 in 132 which increases to 1 in 100. The normal practice of all drivers is to shut off steam when the crest is reached and let the train coast down-hill. Tests made with a Telloc Chart which is fixed to the train-speedometer show that a speed of 33 miles per hour is attained at the top of the crest and the maximum speed at point 97/5 is 45 miles per hour. The Telloc Chart is a graphical record of the speed at which an engine is driven throughout a certain section. The record is made on special paper which is imported and is, therefore, in short supply. The engine of the 1 Down train was not fitted with a Telloc Chart on the day of the accident but on previous occasions the Telloc Charts had shown that the speed of the engine at the point where the accident took place was never more than 45 miles per hour. There is record of three previous trips made by this engine. On 4th September 1957, Bentley drove the engine and attained a speed of 30 miles per hour on the crest and 42 miles per hour at the point of the accident. On 23rd September 1957, D'Souza drove it and the speed at the crest was 33 miles per hour and at the point of the accident 45 miles per hour. On 30th September, 1957, Bentley drove the engine and the

corresponding speeds were 30 miles per hour and 40 miles per hour. Owing to the upward gradient, it is not possible to achieve a high speed at the crest which is at the point 96/12, *i.e.*, about half a mile before the point of the accident. With the regulator shut off, it is not possible to attain in half-a-mile a speed of more than 45 miles per hour and certainly not anywhere near the maximum permissible speed of 60 miles per hour. Bentley said that in accordance with his usual practice which by now must almost have become second nature, he shut off steam at the point of the crest.

The passengers who were questioned on this point also stated that the speed of the train appeared to be between 35 and 45 miles per hour. We must, therefore, rule out the possibility of the accident having been caused by excessive speed or improper application of brakes. Nor is it possible to think of any other act of negligence or incompetence on the part of the driver which could have resulted in this accident.

All the bogies of the train were examined at Bombay on the 23rd November. Train Examiner D'Souza (Witness No. 24) examined the train at 13·30 hours while it stood on the Washing Siding. He found everything in order. Later, Shende, Assistant Train Examiner, (Witness No. 25) examined it on Platform No. 12, where it had been brought in the meantime. Shende also found nothing wrong with the train and obtained the signatures of the Driver and the Guard in the Vacuum Signature Book. The axle boxes of all the bogies were examined at Bombay and Shri Kulkarni, Train Examiner, (Witness No. 26) stated that the axle boxes of the Dining Car alone needed attention. He attended to them and the boxes were repacked with waste and oil on 23rd November 1957. Therefore, before the train left, the axle boxes of all the bogies were in proper condition. The train was examined at Igatpuri and there it was found by Shri Sitoke that one of the axle boxes of the Dining Car was excessively warm. He opened the box and examined the condition of the brass and journal. The brass was in good condition and the journal was bright. He repacked the axle box with oil and waste. Out of abundant caution, he deputed one fitter and one khalasi to go with the train in case the axle became hot again. The accident, however, took place before the Dining Car reached the point of the accident. Therefore, even if there was some serious defect in one of the axle boxes of the Dining Car, this defect was not responsible for the derailment. A hot axle box cannot in any event cause derailment. What happens is that when the axle box becomes excessively hot and is not attended to the heat may cause the axle to break and then a derailment may occur. The Dining Car was examined after the accident and all its axle boxes were found to be in a normal state. Therefore, it follows that the axle box after it was attended to at Igatpuri gave no further trouble, and in any event a hot axle box cannot cause derailment.

We have found it necessary to dwell on the matter of this hot axle because of a suggestion of fire contained in the evidence of two railway police constables Tilore (Witness No. 42) and Mehetre (Witness No. 43). These two constables were on patrol duty on that night and they saw, from a distance while the 1 Down train was passing, a flame coming out of one of the carriages about a foot above the ground. Driver Bentley also said something about a man coming to him and asking for water to put out fire. Bentley when questioned further on this point was somewhat vague and it appeared that he did not fully understand what the man wanted or said. It appears that drinking water was required to revive some of the injured persons. Driver Bentley at that time was mentally upset and excited. His knowledge of Hindi is imperfect and it is obvious that he did not clearly understand what the passenger said to him. There is no evidence that any of the carriages caught fire and the story of the two Railway Constables does not appear to be true. There are certain contradictions in the statement of these two witnesses and when they appeared before the Police at an earlier stage, they gave a somewhat different version of the incident. We, therefore, do not propose to rely upon these two witnesses, and reject the story of the flame which they claim to have seen.

One of the Sainiks of the Railway Protection Force Shri Tukaram Tolaji (Witness No. 41) said that he saw some sparks coming out of the wheels of the train. These sparks were probably the result of the application of brakes after the accident. Be that as it may, it is not possible to attribute the accident to any of these causes and it is clear that the condition of the engine and the bogies was in no way responsible for the derailment.

Lastly, it has been proved that the track was free from any kind of defect on 23rd November 1957. This section of the track had been frequently inspected and any minor defects which were noticed had been attended to and removed. The evidence shows that the following inspections of this track were carried out.

On 31st October 1957, Deputy Chief Engineer, Malvankar, (Witness No. 36) and Permanent Way Inspector, Kankate, (Witness No. 32) inspected the track and found some kinks on the portion 97/5 to 97/10. Work on this portion of the track was carried out on the 8th and 9th of November, and the kinks were removed. This is proved by Gang Mate, Trimbak (Witness No. 30), Sub-Permanent Way Inspector Tamhane (Witness No. 31) and Permanent Way Inspector Kankate (Witness No. 32). The gang chart of Trimbak corroborates the testimony of these witnesses. On 13th November 1957, the Divisional Engineer, Butt, inspected the track and found nothing wrong with it. On 21st November 1957, Permanent Way Inspector, Kankate again inspected the track and found everything normal. On 22nd November 1957, Kankate travelled over this section on a push-trolly and noticed no

defect between Mile 97 and 98. On 23rd November 1957, Kankate passed over this portion in the rear vehicle of a goods train. On the same day, Kamar Rasool, Keyman of the gang-length (Witness No. 29) who inspected the track found it free from any kind of defect. On the evening of the 23rd November, four trains passed over this section without any mishap. These were (i) 5 Down which passed Padali at 19.05 and Asvali at 19.11 hours, (ii) KNE 46 Down which passed Padali at 19.46 and Asvali at 19.58 hours, (iii) BSL 5 Down which passed Padali at 20.37 and Asvali at 20.45 hours, and (iv) KNE 47 Down which passed Padali at 21.18 hours and Asvali at 21.27 hours. This was the last train to pass over the point of derailment before the 1 Down Bombay-Calcutta Mail arrived. The track was, therefore, free from all defects shortly before the accident took place. Nor is it possible to imagine that due to any negligence on the part of gangmen, one whole rail should remain displaced. The workmen must have ceased working before night fall and had the rail not been in position when they left, the four trains enumerated above could not have passed over this section safely. Therefore, the possibility of the accident having been caused by any inherent defect in the track caused by the negligence of railyway employees must be wholly excluded.

The above discussion, therefore, leads to the irresistible conclusion that the derailment of 1 Down Bombay-Calcutta Mail was caused by the deliberate removal of a rail and this removal constituted an act of sabotage.

This disposes of the first question referred to the Commission.

II. PERSONS RESPONSIBLE FOR THE ACCIDENT

With regard to the second point, it is impossible for the Commission to say anything definite or even to make an enquiry into it. The Commission were informed that a criminal case under Section 126 of the Railways Act has been registered by the Police and investigation has been started. The case is, therefore, *sub judice* and it would be improper for the Commission to do anything which might tend to interfere with the investigation or prejudice the subsequent trial of the culprits. The most that can be said is that the aim of the derailment does not appear to have been theft or robbery. There is evidence to show that a goods train was due to pass over this section of the track before the ill-fated Bombay-Calcutta Mail. The train was, however, not ready when the Mail arrived at Igatpuri and so the Mail was allowed to take precedence and proceed to Bhusaval. The goods train had a large quantity of food-grain and it would not have served the looters' purpose if the wagons containing grain had fallen down the embankment and the grain had been spilled. Also it would not have been an easy matter to carry away

large quantities of grain from the spot because the motor road is some distance away. The 1 Down train was carrying four parcels of gold valued at Rs. 61,000 and two parcels of silver valued at Rs. 6,200. These were in charge of the Guard. This was not unusual merchandise for a mail train and it is in evidence that such valuable parcels are usually sent in Mail trains. In any case no attempt whatsoever was made to loot these parcels. In fact, whoever was responsible for the act of sabotage did not make an appearance after the accident and the possibility of the train having been derailed by prospective looters must be ruled out.

There is every indication to show that the offender wanted to inflict the maximum amount of damage upon the train. He chose a spot where the embankment was the highest and, therefore, where the carriages by rolling down to a depth of 30 feet or so would suffer badly. This seems to point to a political motive behind sabotage. It is also possible that a discontented railway employee may have chosen this barbarous way of avenging a real or imagined personal wrong. Nothing definite, however, can be said on this point by the Commission and it is for the Police to discover the criminals and enquire into the motive which prompted the dastardly act. All that the Commission can say is that the act of sabotage was committed by some person or persons unknown.

III. WHAT SAFEGUARDS CAN BE SUGGESTED AGAINST SIMILAR ACCIDENTS IN FUTURE

The third and the last question referred to the Commission gave rise to the most difficult and, it must be confessed, the least successful part of our labours. Acts of sabotage have been committed on several sections on Indian Railways from time to time as indicated below, and fortunately only a small percentage of these have resulted in derailments and serious accidents entailing loss of life:—

Year		Cases of	
		Attempted Train Wrecking	Trains Wrecked
1949-50	..	135	12
1950-51	..	181	15
1951-52	..	134	6
1952-53	..	87	3
1953-54	..	77	3
1954-55	..	84	1
1955-56	..	73	3

The opportunities for sabotage and the facility with which the railway track can be damaged make it impossible to provide completely effective safeguards against the criminal activities of saboteurs.

The total route-mileage of Government Railways in India is over 34,000 miles. It is quite impossible to keep a constant watch over every yard of the track and to protect it completely and at all times from unauthorised interference. In such a vast field stretching over thousands of miles, the offender can, at will, remove a rail at a suitable point and within the space of a few minutes do irreparable damage. It is impossible to anticipate the time or the place where a saboteur (whether his motives be political or personal) will strike.

The ideal anti-sabotage measure should offer complete resistance to the predatory intentions of a criminal, making it impossible for him to interfere with the track; and at the same time it should not present any obstacle or difficulty in the way of maintenance and the routine operations necessary to keep the track in perfect running order. These two factors operate in contrary directions. To give one or two instances only, it is necessary to remove the fish-plates once a year and lubricate each and every rail-joint to permit free movement of rails with temperature variation and prevent the track from buckling under the stress of rail expansion due to rise in temperature. Any device which makes it impossible or even difficult to remove the fish-plates for this periodical routine attention will detract from the efficiency of maintenance staff. Again, where it becomes necessary to realign the track or eliminate elbow-kinks, rail-joints require to be eased and the keys loosened. If this process is made difficult as an anti-sabotage measure, a slothful or unconscientious workman, when faced with the need to take a little extra trouble, will be apt to neglect his duties and scamp him work. The remedy may in such cases prove as disastrous as the disease.

It would, therefore, seem that at best it is only possible to make a compromise between these two opposing factors. The endeavour of the Railway Administration has naturally been restricted by the inevitable limitations imposed by the necessity of efficient track-maintenance operations.

Measures have, however, been suggested from time to time, and as was only to be expected the Railway Administration have given the matter a great deal of thought. On 2nd May 1950, a Conference of the Chief Engineers was held at Delhi to consider anti-sabotage measures. A large number of suggestions was received for consideration at this meeting. Many of them were considered impracticable and of little utility. We have examined all the suggestions made and we are generally in agreement with the decisions reached at this meeting. There is no doubt that many of the suggestions were wholly impracticable and would not

constitute effective safeguards against sabotage. It would be a waste of time even to refer to them in this Report. We propose, however, to deal with some of the more effective measures which the Conference of the Chief Engineers considered worthy of trial at their meetings on 2nd May 1950 and 26th February 1957. We have in addition given our attention to some other aspects of this matter and we propose to deal with them also. These measures may be enumerated as follows:—

(i) Burring or rivetting of fish-bolts, so as to make it difficult to remove the fish-plates.

(ii) Shearing the ears of dog-spikes used on wooden sleepers. This measures makes it difficult to remove the dog-spikes.

(iii) The use of reversed jaw CST-9 plate-sleepers in conjunction with the normal type, which makes it difficult to loosen the rail even after the fish-plates are removed.

(iv) The use of non-removable keys on four-keyed Steel-trough sleepers fitted with loose jaws. This measure is intended to make it difficult to remove a rail even after unfishing the rail-joints.

(v) Staggering of rail joints. This makes it difficult to slew the track by opening the rail-joints which are normally opposite and square to one another.

(vi) Welding of rail joints.

(vii) A better type of headlight on the engine front.

(viii) Intensive patrolling of the track.

(i) Burring or rivetting of a fish-bolt is done by hammering hard the end of the bolt after the nut has been screwed on to it. This flattens the end of the bolt and makes it difficult to unscrew the nut. Experiments made in the presence of the Commission, however, prove that this is not at an effective way of preventing sabotage. A burred bolt can be removed without much difficulty though the removal needs a little more force and takes a little longer than the removal of an ordinary bolt. When forced out, the bolt and the nut are damaged. The difference in time between the removal of a burred bolt and of an ordinary bolt is only about $1\frac{1}{2}$ minutes. A rail was jointed at its two ends by means of one burred bolt and three ordinary bolts fixed to the fish-plates. One village labourer (not a skilled gangman) was able to remove the two fish-plates completely in 3 minutes and 10 seconds. The time taken in removing a pair of fish-plates fitted with ordinary bolts is a little more than 2 minutes. The burring of bolts will inevitably interfere with the operation of periodical lubrication of rail-joints and maintenance involving the loosening of rails, and gangmen shirking work

will be inclined to skip the necessary process wherever there is a burred bolt because the unscrewing of the nut of a burred bolt requires more time and energy. The burring of bolts is certainly not an effective anti-sabotage measure because two men determined on loosening a rail or displacing it altogether can do so within a few minutes. Also this measure entails extra expense because the nut and the bolt are damaged though with the use of specially long bolts and washers, it is possible to use the same bolt three or four times by cutting off a small piece from the end each time the bolt is removed. For this reason, the Commission is not prepared to recommend this measure both because it is ineffective and costly and because it will tend to interfere with the efficient maintenance of the track.

(ii) Dog-spikes are used on wooden sleepers. They have to be removed occasionally for the proper maintenance of the track. A special bar with a claw at one end is used to prize out the dog-spikes. If the two projecting sides at the head of the dog-spikes which are called ears are sheared off, the claw cannot be used to prize it up. It is, however, quite a simple matter to deal with a dog-spike of this type, as a violent blow on its head with a hammer will break off the projecting end which holds the foot of the rail down and this will free the rail.

Earless dog-spikes are being used extensively on the Northern Railway and a specially designed tool is used to extract these spikes when extraction becomes necessary to loosen a rail in order to attend to any defects in the track. This tool is kept in safe custody and is not part of the normal equipment handed out to gangmen. But, since it is easy to make the rail free of earless dog-spikes, this measure, in our opinion cannot effectively prevent sabotage. Burred bolts are in use on the Northern Railway, but there is hardly any evidence to indicate the extent to which they have offered resistance to acts of sabotage.

(iii) The reversed jaw CST-9 plate-sleeper used with the normal type is a somewhat more effective and practicable measure. Its use does not interfere in any way with the maintenance of the railway track and an experiment made in the presence of the Commission showed that a gang of unskilled men could not easily remove a rail in which there were 3 reversed jaw CST-9 plate-sleepers. Four village labourers were unable to displace a rail fastened in this manner in 20 minutes. The experiment was performed in day time and the Commission were of the opinion that it would be even more difficult to deal with a rail fixed in this manner at night when it might take an hour or more before the rail can be displaced. The element of surprise adds to the difficulties of removing a rail in the dark and a saboteur would not ordinarily be expected to use a light when he is interfering with the track at night. This measure does not involve any extra cost and does not interfere with track maintenance operations. The Commission are therefore, of the

opinion that the reversed jaw CST-9 sleepers should be used extensively along with the normal type as an anti-sabotage measure.

(iv) Non-removable keys can be used exclusively on four-keyed Steel-trough sleepers fitted with loose jaws. This measure is in force to some extent on the Northern Railway. A statement supplied to the Commission shows that the total route-mileage on the Northern Railway having non-removable keys is 250 miles. There is nothing to show that the adoption of this measure has had any effect on the incidence of acts of sabotage. The Commission witnessed a demonstration of dismantling with a bent chisel and hammer the non-removable key and the jaw holding it. A non-removable key can be undone in a few seconds and does not provide an adequate measure of safeguard against sabotage.

(v) Normally, the track is laid with rail joints square and opposite to each other. It is easy to undo the fish-plates of the two joints and slew the track to one side by levering it over in the course of a few minutes. The staggering of joints is intended to deal with this type of sabotage. We do not, however, think that anything can be gained by staggering the joints. It detracts from the smooth running of coaches and proves a source of discomfort to passengers. The removal of a single rail can cause derailment as indeed it did in the present instance. We do not, therefore, think that staggering of joints will in any way deter a saboteur who wishes to damage or interfere with the track in order to cause an accident.

(vi) The welding of rail joints in India is still in the experimental stage. Welding on the scale carried out in Canada and some Western countries is perhaps not possible in India where conditions are different and extremes of temperature are experienced. It would appear that there is considerable expansion and contraction of rails and large scale welding would interfere with the free play which the present system of rail-jointing permits. Experiments are, however, being carried out and the welding of 5 consecutive rails, each 42 feet in length, has been successfully tried. Apart from the economic aspects, the purpose of welding rail joints is to make the running of a train smoother and more comfortable for passengers, but there is no doubt that it also offers some resistance to saboteurs. We would, therefore, suggest that experiments in this direction should be continued and attempts made to adopt this measure on as wide a scale as possible, consistently with the safety of the track.

(vii) A better type of headlight on the engine is another measure which commended itself to the Commission although it cannot be considered as a wholly effective anti-sabotage device. Headlights on engines were introduced in 1929. No headlight are used in European countries and the drivers drives the engine blind. The high speed at which fast trains are driven and the multifarious nature of the engine driver's duties

(he has to look out for signals, directions on the track regarding speed restrictions and whistle boards, attend to the water level gauge and other instruments in the engine) make it impossible for him to keep his eyes constantly on the track in front of him. It must be remembered that an engine is not driven in the same manner as a car on a motor road. The engine driver's seat is approximately 40 feet behind the front of the engine. He obtains his view of the track through the look-out glass hinged on either side of the cab. On the straight, he is able to get a good view of the path ahead of him through either of these look-out glasses. On a right-hand curve nothing obstructs his view, physical features excepted. On the left-hand curve, his visibility is reduced to nil, because the boiler completely obstructs his view of the track as the Commission saw in the course of a practical trial when the engine was driven at night. Therefore, when the track takes a left-hand curve, either the driver must go over to the left side of the engine and look through the left-hand look-out glass or he is unable to see the track ahead. When he is driving over undulating terrain, involving several curves in both directions, he cannot be constantly running to and fro. He has either to depend on his fireman who may be busy at that very moment stoking the fire or he must content himself by trusting to providence and hoping that the track ahead is perfectly normal. When he is keeping a diligent look-out from his seat, it is easy for him to pick out a major obstruction on the track but a loose fish-plate or a displaced rail will almost certainly escape his attention. Even on a straight run, he may not be able to stop himself in time if he notices a discontinuity in the alignment of the rails.

The Headlight in use at present is a 250 watt 32 volt lamp with a parabolic reflector which according to specification projects a beam of approximately 1,000-feet in length. The illumination of an object varies in inverse proportion to the square of its distance from the source. With a single central headlight as ordinarily used, the visibility of a large sized vertical object is about 700 feet as found by the Commission in the course of a test carried out at night. The visibility distance for rails to be clearly seen is not more than 200 feet.

A train consisting of a WP engine and 10 bogies travelling on the level at a speed of 60 miles per hour will, on the emergency application of brakes, come to a dead stop in the space of 2,400 feet as stated by Shri R. S. Krishnan, Joint Director, Mechanical Engineering, Railway Board. There is a brief but appreciable time-lag between the moment when an obstruction or defect in the track is noticed and the actual application of the brakes. Even a driver possessing many years' experience and gifted with quick nervous reactions will need a moment or two before he realises the real import of what he has observed and decides to take action in order to avoid a possible calamity.

From this, it is clear that if there is a discontinuity in the track, the driver will not see it till he is about 200 feet from it, and then it is too late to avoid an accident. We feel, however, that the detection of discontinuity even at a distance of 200 feet is a very difficult matter and the driver may wholly fail to notice it. A number of experienced drivers were examined by the Commission and each of them was asked the following question:—

> "Q.: Suppose you are starting from Igatpuri on your run to Bhusaval at night; you are told to run the train at normal speed; you are also told that one rail has been removed and put aside somewhere on the section. Do you think you can avoid an accident?"

The reply of every driver was that it was impossible to avoid the accident. It follows, therefore, that when a driver drives an engine at normal speed, he cannot with a normal headlight of the type provided at present avoid an accident in circumstances in which 1 Down Mail was involved on November 23. Indeed, it is somewhat doubtful if any improvement in the headlight can prove completely effective and it seems that an accident of this type may well occur even during day light because an engine driver does not keep his eyes fixed on the track ahead of him for every moment of the run. The Commission feel, however, that matters could be improved by providing the engine with a better type of headlight. This, in our view, means a light with a stronger and more powerful lamp and one which is provided with an automatic swivelling mechanism which would deflect the beam of light to the right on a right-hand curve and to the left on a left-hand curve. Experiments made by the Commission with improvised swivelling lights proved that the visibility is improved considerably. Mr. Gurr, the Chief Mechanical Engineer, arranged to fix two side lights and two central lights on the smoke box equipped with a manually operated swivelling arrangement. Experiments were made on two separate nights with the two types of lights mentioned above. The Commission formed the opinion that a central swivel light on the smoke box gave better results and considerably improved the visibility. The visibility distance of a large sized vertical object on a straight run with two headlights side by side was about 900 feet. On curves, there was no diminution in visibility when the swivelling arrangement was operated. An automatic swivelling device would, we feel be a great help to the engine driver. Also we feel that emphasis on lighting arrangements will go to focus the driver's attention on the necessity of keeping a constant and vigilant lookout on the track ahead of him. The necessity of headlights has been recognised and this matter is dealt with in General Rule 143 of the Rules for Indian Railways. The relevant portion of this Rule is as follows:—

"G.R. No. 143:

(a) At night, and in thick or foggy weather, no train shall be worked outside station limits unless it has the headlights, at least two

in number, prescribed by the Railway Administration, or an electric headlight in front of the chimney, of a pattern approved by the Government Inspector.

* * * *

(c). When in accordance with sub-rule (a) an electric headlight is used on a locomotive other than an electric locomotive, the engine shall carry at least two oil headlights for use in case the electric headlight fails."

The relevant portion of the Subsidiary Rule applicable on the Central Railway is as under:—

"S.R. 143-1:

In the event of the Electric Headlight being defective, the driver shall—

(i). Pass a memo to this effect to the Shed-in-charge on duty, and

(ii). Light his two buffer beam oil lights and work the train at a speed not exceeding 40 miles per hour during the hours of darkness."

Unlike the Railways in European Countries, engines in India are not driven at night without headlights and for a headlight to be effective, it must be brighter and better than the headlight which is in use at present on the Indian Railways.

The specification of the headlights in use at present is as follows:—

"The projector shall be of the concentrated beam type and shall be fitted with 14" or 18" diameter reflector as specified by the Purchaser and a 250-watt 32-volt lamp which shall project a beam of not less than 1000-feet in length. The intensity at a point in the centre of the beam at that distance shall not be less than 0·3 foot candles and the angle of the beam shall be not less than 70."

It is not quite clear on what data the figure of 1000 feet is based. In actual practice, the lamp which is in use on the Indian Railways does not give visibility to a distance of anything like 1,000 feet. It seems that this figure is based on a decision taken in 1932. In the 25 years which have elapsed since then considerable improvements might be expected to have been made in the design and manufacture of Headlights. We examined Shri L. N. Mathur, Director, Electrical Engineering, Railway Board, on this matter, but there is nothing in his statement to indicate that any improvement has in fact been effected. He said that three different lines of research for improving headlights had been explored and they are:—

(i) Provision of a lens in front of the lamp;

(ii) Improving the Reflector; and

(iii) Improving the wattage of the bulb.

With regard to the first item, he said that it was not possible to make a lens of the size required nor would the addition of a lens in front of the lamp improve matters, as there would be loss of parallel and convergent rays in travelling through 1,000 feet and the intensity of illumination would not be increased. With regard to the second item, he said that the reflector in use at present is a parabolic reflector and this is not susceptible of further improvement. On the third item, he stated that attempts were being made to improve the lighting by a 400/500 watts bulb, but a higher wattage would necessitate an increase in the dimension of the lamp and this may detract from the focussing capacity of the reflector. Shri Mathur frankly confessed that the objective of the proposed engine headlight had not been clearly defined in terms of the intensity of illumination required at particular distances.

The Commission took advantage of Prof. M. S. Thacker's presence in Delhi to seek his advice on the matter of improving visibility on the track at night. Prof. M. S. Thacker, who is the Director General, Council of Scientific & Industrial Research, and, Secretary, Department of Scientific Research & Technical Education, indicated certain avenues of research which should be pursued. There were difficulties, both technical and financial, in adopting some type of radar apparatus on railway engines. He further pointed out that there was an uncertain factor, *viz.* the visual capacity of the human eye. Prof. Thacker could not express any opinion about the exact limitations placed by this circumstance and he said that only an expert optician was competent to decide this matter. An improved reflector, prismatic or parabolic, would go a long way to increase visibility on the track. The Professor suggested the constitution of a High Level Committee to examine the question of improved visibility and issuing a directive to the organisation under his control with a definite time limit, say of 6 months, to solve the problem. He assured the Commission that the scientific personnel under his control would extend the fullest co-operation and assistance in evolving a design for a sufficiently powerful headlight.

Having regard to the breaking distance of trains, it seems to us that some form of headlight which illuminates the track upto an adequate distance should be devised. The exact measure of the distance can be determined by the High Level Committee suggested by Prof. Thacker. For this purpose, a lamp of a higher wattage set against a better type of reflector will have to be manufactured and in our opinion, it is worthwhile making an attempt to design such a headlight. There should also be an automatic swivelling arrangement which would improve visibility over curves and bank formations.

The Commission, therefore, recommend the constitution of a High Level Committee of the Railway Department to consider this matter.

The Committee will examine the question of visibility, taking expert medical evidence, if necessary, and after considering the matter from all aspects, it will formulate a concrete proposal indicating the measure of illumination required, the length of the track which should be lit up by the headlight and the exact nature of the swivelling arrangement. The objective having been thus determined, the scientific personnel will undertake the designing of an appropriate headlight.

We may, however, add that we are conscious of the physiological limitations of the human eye and visibility conditions depending upon the height of the observer while travelling in a railway engine. The height of the railway headlight as also of the driver's eye, when he is sitting on his seat, is 10 feet above the track. A simple geometrical calculation will show that a vertical object of 6 feet high placed at a distance of 1,000 feet from the engine will cast a shadow of 1,500 feet upon the horizontal track. This amounts to the same thing as saying that a horizontal object 1,500 feet in length lying on the track at a clear distance of 1,000 feet from the engine will appear to the eye of the observer in the engine as a vertical object of 6 feet. A rail 42 feet long situated at a distance of 1,000 feet from the engine will appear as a vertical object of 5 inches because a vertical object of this size situated at a distance of 1,000 feet will cast a shadow of 42 feet. From this, it follows that it is not an easy matter to see a displaced rail from a distance of 1,000 feet because a gap in the rails will not be visible more clearly than a vertical object 5 inches high. Therefore, the capacity of the human eye to view objects at large distances is not greatly improved by better illumination and it seems doubtful if even in day time such a fault in the line can be detected promptly and easily.

We, however, feel that a substantially increased measure of safety will be achieved with the use of a powerful lamp which will light up the track better and increase the prospects of detection as far as obstructions and glaring track faults on the line are concerned. It is hoped (and the Commission cannot put it on a higher level than this sanguine hope) that the driver may be able to reduce his speed if he is not able to stop his train in time.

(viii) Adequate patrolling of the track is a measure that is reasonably effective, though very expensive. Statistics were prepared of instances of tampering with the track and obstructions placed on the line on the Central Railway system during the period 1952 to 1957. The various types of sabotage were plotted on charts to see if a recognisable pattern could emerge from the history of acts of sabotage during the last six years. There are generally four types of acts of sabotage—

(i) Tampering with the track;

(ii) Placing obstructions on the line;

(iii) Lubrication of the rail table on Up gradients to stall trains; and

(iv) Tying up of signal wires to stop trains at the signal which cannot be operated.

Acts under items (iii) and (iv) are for the purpose of stopping and looting trains, not wrecking them. It is, however, not possible to draw any definite conclusions from the charts prepared and it cannot be said that any particular section of the track is more vulnerable or inviting to the saboteur than another. A saboteur can choose his own spot for his activities and for patrolling to be effective every mile of the railway track will have to be kept under close and constant watch. This is obviously impossible. During the monsoon season, patrolling of the railway line to a specified system that affords "maximum protection" to trains is undertaken between the hours of sun set and sun rise to detect damage by flood and stop traffic in emergency. The patrol beat is 2 to 3 miles. In addition, watchmen are posted at bridges, culverts and mileages vulnerable to damage by flood. Sections over which trains do not run at night are not patrolled. The cost of monsoon patrolling on the Central Railway is about Rs. 3,70,000 per month. Calculations made for the intensive patrolling of the entire track as a security measure on the Central Railway, allowing four men per mile in two shifts, indicate that the cost would be nearly Rs. 31 lakhs per month. It will be seen at once that even patrolling on this large scale cannot prove wholly effective because it takes only a few minutes for saboteurs to remove a rail even if they are unfamiliar with the process. Some kind of security patrolling would, however, be necessary but there should be no definite or prescribed pattern and beats should be arranged *ad hoc* the previous night. There should be constant surprise visits of inspection by higher officials who should check whether the security patrolmen are performing their duties with diligence. The scheme should, however, be worked out so that the cost does not become prohibitive. Security-patrolling can be supplemented by a scheme whereby the residents of villages are made responsible for the safety of the track passing through their villages. Such a scheme is usually enforced on special occasions and is known as the "Village Responsibility Scheme". An attempt should be made to make this a permanent feature, because in our view interferences with the track are always within the knowledge of the villagers and if the residents are made responsible for the safety of the track, they will exercise greater vigilance and industry in this respect.

It is distressing to note that security patrolling was actually being done by the Government Railway-Police and the District Police on the section of the line between Padali and Asvali on the night the accident under Inquiry took place. There had been several cases of greasing the rails with a view to stopping trains on the upward gradient and looting them. So about a year before this accident took place, a decision was

taken to patrol the line. Patrolling was being done by the Government Railway Police and the District Police. The Railway Protection Force, formerly known as the Watch & Ward Department, rendered assistance to the Government Railway Police and the District Police as and when required by deputing their staff (Sainiks) to accompany the Police Patrols. There was, however, a singular and very regrettable lack of co-ordination between the Government Railway Police, the District Police and the Railway Protection Force. No regular system was formulated and no instructions regarding the mode of patrolling were given either to the Railway Police or to the District Police personnel. The District Superintendent of Police, Nasik, who was informed of the cases of greasing, did not take any interest in the matter and he appeared to be wallowing in blissful ignorance of how the patrolling was being done over this section of the Railway. On the night in question, four Railway Police Constables, assisted by two Sainiks, were deputed to patrol certain portions of the track between Padali and Asvali. Two Sainiks and two Constables were deputed on the Up track and two Constables on the Down track. In addition, two District Police Constables were deputed to patrol both the tracks between Padali and Asvali. Despite this protective measure, the rail was removed, as it were, from under the very nose of the Police. But after hearing the evidence of the Police Constables, we were not surprised that this happened. The patrolling staff had no definite idea of what they were supposed to do. The impression we gathered was that the patrolling was being done in name only. The story given by Constable Mehetre is quite unbelievable. He says that he and Constable Kulkarni travelled from Igatpuri to Asvali by train and reached there at 15-45 hours. The patrolling was to begin from Padali. There was a train from Asvali which reaches Padali at 18-31 hours but the Constables did not choose to take this train and covered the 5 miles to Padali on foot. The Constables had to meet the Sainiks of the Railway Portection Force at Padali and the Sainiks travelled by this very train reaching Padali at 18-31 hours. It is difficult to understand why Mehetre and his companion should have chosen to walk a distance of 5 miles when they could easily have travelled by train and reached their destination well in time. The story of Constable Tilore is that all the four constables travelled by train from Igatpuri to Asvali and at Asvali two of the constables detrained but he could not say as to what happened to the other two. He could not remember whether all four of them travelled in the same compartment. He stated that he walked from Asvali to Padali but strangely enough not in the company of Mehetre. When questioned why he did not travel by train, he made the strange reply that the train did not stop at Padali. The train No. 382 Up does in fact stop at Padali and it was by this train that the two Sainiks travelled from Nasik. If a careful analysis of the evidence of these four witnesses (Sainik Tolaji, Witness No. 41, Constable Tilore, Witness No. 42, Constable Mehetre, Witness No. 43 and Head Constable

Gole. Witness No. 44) is made in order to determine the exact movements of the members of the patrol during the night, a hopeless confusion ensues and it is impossible to find out what the patrols were doing and where they were at different times in the night. We have thus been driven to the conclusion that although eight men were deputed in three batches to patrol the track that night, no patrolling was in fact being done. This is a distressing state of affairs and such indifference towards duty amounting almost to a callous disregard of public safety is to be deprecated. Patrolling of this type is worse than no patrolling as it induces a false sense of security.

The question of security patrolling of the Railway Line, as distinct from regular patrolling during the monsoon period, must be handled with foresight and imagination and not disposed of in an utterly casual and careless manner. It is not possible to guard the entire track of 34,000 route miles in the intensive manner undertaken on special occasions, e.g., when some high dignitary or foreign potentate travels by train, because the expense involved would be prohibitive even if it were found possible to secure the vast numbers of men required for this purpose. But we have no doubt at all that much can be achieved and a large measures of safety can be secured by more intelligent and conscientious patrolling of those sections of the Railway which past experience has proved to be especially vulnerable or where an act of sabotage may be expected.

For Security-patrolling to be effective, there must be complete co-ordination between the District Police, the Railway Police and the Railway Protection Force as the safety of the travelling public is as much a concern of the Police as of the Railway Administration. Tampering with the railway track is a criminal offence and the consequences that result therefrom come within the purview of the machinery which deals with Law and Order. We suggest that these three agencies should work together. There should be frequent consultations at the district level between them and occasionally at a higher *i.e.,* inter-district and inter-state level. An effective scheme should be devised and put into effect. This should have an element of surprise. This can be achieved by laying down different programmes of which one may be chosen at random for any particular day. There should be frequent visits by the higher officers to see that patrolmen are carrying out their duties properly. A certain amount of responsibility can be thrown on the residents of the neighbouring villages.

Another suggestion which the Commission would like to make is that no sooner a case of this type is reported, a substantial award should be offered to anyone giving information leading to the arrest of the offender. It must be remembered that cases of sabotage on the Railways usually involve more than one person. The offer of a substantial award

may induce one of them to come forward as an informer. On especially vulnerable sections, a Mobile Patrol to a varied programme will have a salutory effect in acting as a check over the patrolmen and to some extent serve as a detterent to saboteurs. The question of staggering monsoon-patrolling should also be examined.

The Commission is also of the opinion that special legislation to provide enhanced and deterent penalties on those found guilty of interfering with the railway track should be undertaken. We cannot lay undue emphasis on the fact that even if an act of sabotage does not result in a fatal accident, it is pregnant with very grave danger to human life, and a person found guilty of perpetrating such a crime should be dealt with severely.

The Commission has not been called upon to make any observations on the manner in which medical aid was rendered to the persons injured in this accident. A few words, may, however, be said on this subject in order to complete the story. Information of the accident was sent by telephone to Igatpuri and Manmad and medical assistance was rushed to the spot from several quarters. Brigadier Sathe from Devlali also arranged for Doctors and Nurses to go to the spot. The evidence produced before the Commission showed that prompt medical aid was given to all the injured persons, and those needing attention at a hospital were promptly removed from the spot and attended to. Dr. Venkatraman reached the spot at 00.15 hours. The Igatpuri breakdown train bringing medical assistance arrived half an hour later. A special military type bogie reached the scene of the accident at 2-10 hours and transported 32 of the injured persons to Igatpuri by 5 A.M. The promptness and the energy with which the Doctors and Nurses attended to the injured persons is to be greatly commended.

Summing up briefly, we would state our conclusions as follows:—

(1) The accident caused to the 1 Down Bombay—Calcutta Mail on 23rd November 1957 was the result of a deliberate act of sabotage committed by some person or persons unknown.

(2) It is impossible to suggest any measures which will completely and effectively prevent sabotage or detect it in time to avoid an accident, but a substantial measure of security can be achieved by—

(a) The use of reversed jaw type sleepers in conjunction with the normal type on CST-9 plate-sleepered track at the rate of at least 3 per rail length. This measure does not involve any extra cost nor does it interfere with regular track maintenance.

(b) Welding of rail joints. This measure offers some resistance against sabotage attempts and apart from the saving in rail joints and maintenance expenditure, has the added advantage of

affording smoother running and reduced wear and tear of rails and wheel tyres.

(c) A more powerful engine headlight with swivelling arrangement to light the track better and increase the possibility of detection of obstructions and track faults. The consideration of this matter should be entrusted to a high level committee as indicated in the earlier part of this Report.

(d) Effective security patrolling over those sections which previous experience has proved to be vulnerable or where acts of sabotage may be expected. Complete co-ordination between the District Police, Railway Police and the Railway Protection Force at all levels is imperative. The system of patrolling should include an element of surprise by laying down varying programmes of which one may be chosen at random for any particular spell. A mobile vehicular patrol acting as a supervisory check over the system of foot-patrolling will have a salutory effect. The question of associating the residents of adjoining villages should also be examined.

(e) Special legislation to provide deterrent penalties on those found guilty of attempts at train wrecking.

(f) The offering of substantial awards to those who give information leading to the arrest of saboteurs.

In conclusion, the Commission would like to place on record their appreciation of the excellent work done by P. B. Aibara who acted as Secretary to the Commission. His industry in preparing a large number of notes and statements and his efficient handling of the material relating to this Inquiry facilitated our task to a very great extent. We wish to thank him and the Railway Administration for the assistance rendered to us in the whole course of the Inquiry. We would like to add that at every stage of the Inquiry we experienced complete frankness on the part of the Railway Administration and their willingness to give every type of information and render every kind of assistance. Mr. K. J. Khandalawala, who represented the Central Railway, conducted the case in a very able and at the same time scrupulously fair manner. The Commission is indebted to him for the very valuable assistanse he rendered in the course of the Inquiry.

J. N. NANDA, *Member.* JUSTICE G. D. KHOSLA, *Chairman.* DR. P. SUBBARAYAN, M.P., *Member.*

NEW DELHI,
24th January 1958.

ANNEXURE 'A'

RESULTS OF TESTS CARRIED OUT BY THE COMMISSION OF INQUIRY ON ANTI-SABOTAGE DEVICES PERTAINING TO TRACK :

Dates of Tests – – – 17th and 23rd December, 1957.

Site of Tests – – – Nasik Road Station Yard, Central Railway

Track Structure – 90 R, 42 feet rails on CST 9 sleepers N + 6 Density, or 20 per rail length.

Sample Track – – – Rail-lengths laid with/without 3 Reversed Jaw CST 9 plates per rail length and with/without burred fish-bolts, one per rail-joint.

Class of Labour – – Permanent Way Gangmen and Village Labour.

Equipment – – – Crow bars, Keying hammer, punch and fish-bolt spanners.

I. OPERATIONS BY PERMANENT WAY GANGMEN :

TEST No. 1.—*Displacement of one Rail from Track laid with Three Reversed Jaw plate-sleepers one at the middle and one each at the two "shoulders" and one bolt burred at each rail-joint.*

Particulars of Operation	Time taken
(*a*) *Strength : Six Gangmen.*	
Removal of keys and unfastening rail-joints – –	4 Mts. 0 Second
Displacing Rail by levering, 15″ to 18″ from normal alignment after loosening cores and shifting the reversed jaw CST 9 plates.	0 Mt 30 Seconds.
TOTAL TIME TAKEN – –	4 Mts. 30 Seconds.
(*b*) *Strength : Four Gangmen.*	
Removal of keys and unfastening rail-joints – –	3 Mts. 15 Seconds.
Displacing Rail by levering, 15″ to 18″ from normal alignment.	2 Mts. 30 Seconds
TOTAL TIME TAKEN	5 Mts. 45 Seconds.

NOTE.—Time taken for re-inserting the rail with Six Gangmen was 3 Minutes 30 Seconds.

TEST No. 2.—*Unfastening One Pair of Rail-Joints with burred bolts and Slewing Track.*

Particulars of Operation	*Time taken*
(*a*) *Strength : Six Gangmen.*	
Unfastening Rail-Joints – – – – – –	3 Mts. 30 Seconds
Slewing Track on one side by 6″ from normal alignment	0 Mt. 25 Seconds.
TOTAL TIME TAKEN – – –	3 Mts. 55 Seconds.
(*b*) *Strength : Four Gangmen.*	
Unfastening Rail-Joints – – – – – –	3 Mts. 45 Seconds.
Slewing Track on one side by 6″ from normal alignment –	0 Mt. 35 Seconds.
TOTAL TIME TAKEN – – –	4 Mts. 20 Seconds.

II. OPERATIONS BY VILLAGE LABOUR :

TEST No. 3.—*Complete Displacement of One Rail from Track laid and fastened normally.*

Particulars of operation	Time taken
Strength : Four Village Labourers.	
Removal of keys and unfastening Rail-Joints	1 Mt. 45 Seconds.
Displacing Rail by levering it, 15" to 18" from normal alignment	1 Mt. 17 Seconds
TOTAL TIME TAKEN	3 Mts. 2 Seconds

TEST No. 4.—*Unfastening One Rail-Joint with One burred bolt.*
Strength : One Village Labourer.

Time taken for complete removal of fish-plates	3 Mts. 40 Seconds

TEST No. 5.—*Displacement of One Rail from Track laid with Three Reversed Jaw plate-sleepers, one at the middle and one each at the two "shoulders", and one bolt burred at each Rail-Joint.*

Particulars of Operation	Time taken
Strength : Four Village Labourers.	
Removal of keys and fastening Rail-Joints	4 Mts. 20 Seconds
Displacing Rail by levering	Unable to tilt rail after 20 minutes from start of operations. Test stopped.

III. OBSERVATIONS :

1. Gangmen who know the track-structure could break the CST 9 Sleepered rail-road aid with reversed jaw plates and burred bolts in about 5 minutes.

2. With Permanent Way Tools, village-labour, not aware of the track-structure, could break a CST 9 sleepered rail-road laid and fastened normally in less than 4 minutes. Where this type of track is laid with 3 reversed jaw plate sleepers to a rail-length, removal of a rail by unpractised Village-labour is difficult.

3. A Rail-Joint with one burred fish-bolt could be unfastened by unpractised village-labour in less than 4 minutes. Keys could be hammered out by unskilled labour with ease. Such conditions, by themselves, seriously endanger the safety of rail-traffic.

ANNEXURE 'B'

RESULTS OF TESTS CARRIED OUT BY THE COMMISSION OF INQUIRY ON VISIBILITY FROM THE DRIVER'S SEAT WITH ENGINE HEAD-LIGHT PROJECTORS.

TEST No. 1

Date of Test	19th December, 1957.
Section	Devlali to Igatpuri on Up Line and Igatpuri to Devlali on Down Line.
Weather	Clear and cloudless. Moonless night.
Speed	During Test Runs, the maximum speed was 50 miles per hour.
W.P. Engine]	Fitted with normal Head Light Projector located ahead of the smoke box on centre line of the boiler. In addition, fitted with two Head Light Projectors, one over each and of the front buffer beam. Independent switches controlled the central and each of the two side lights. Each projector of the concentrated beam-type fitted with a 250 watt. 32 volt lamp. (Stone's Tonum Head-light).

No swivelling arrrangement provided.

NOTE.—Distance from Driver's seat to front of engine, 43 feet.

OBSERVATIONS

I. STRAIGHTS :

(*a*) *With the single Central Head Light* :

(*i*) The visibility distance for a large sized vertical object is of the order of 700 feet ;

(*ii*) The visibility distance for rails to be fairly clearly seen is of the order of 200 feet.

(*b*) *With the Two Side Lights* :

(*i*) The visibility distance for a large sized vertical object is somewhat more than with the single central Head Light and of the order of 900 feet:

(*ii*) The rails could be 'picked out' better than with the single central Head Light and the visiblity distance is of the order of 300 feet.

NOTE.—At "summits" or "sags" the visibility is diminished for a short interval of time.

II. RIGHT-HAND CURVE ON LEVEL, ON BANK OR IN SHALLOW CUTTING:

(*a*) *With the Single central Head Light* :

(*i*) The visibility distance for a large-sized vertical object is dependent on the curvature and varies from 150 to 300 feet.

(*ii*) The visibility distance for rails to be clearly seen is dependent on the curvature and varies from 50 to 150 feet.

(*b*) *With the Two Side Lights* :

(*i*) The visibility distance for a large-sized vertical object is dependent on the curvature and varies from 200 to 400 feet.

(*ii*) The visibility distance for rails to be clearly seen is dependent on the curvature and varies from 100 to 200 feet.

NOTE.—While the Right-hand rail is visible throughout from the driver's seat, the left hand rail is obscured immediately ahead by the boiler.

III. RIGHT-HAND CURVE IN MEDIUM OR DEEP CUTTING :

Where the cutting is wide on account of contiguous double-line or multiple tracks, nearly the same conditions as stated under II above are obtained. Where, however, the formation is for single line, the physical features, *viz.*, the sides of the cutting, restrict the visibility.

IV.—LEFT-HAND CURVE ON LEVEL, ON BANK OR IN SHALLOW CUTTING :

From the driver's seat, the visibility is practically nil. From the left side of the cab, the same conditions as stated under II above are obtained.

V. LEFT-HAND CURVE IN MEDIUM OR DEEP CUTTING :

From the Driver's seat, the visibility is practically nil. From the left side of the cab, the same conditions as stated under III above are obtained.

TEST NO, 2

Date of Test	23rd December, 1957.
Section	Devlali to Igatpuri on Up line and Igatpuri to Devlali on Down Line.
Weather	Clear and cloudless. Moonless night.
Speed	During test Runs, the maximum speed was 45 miles per hour.
W.P. Engine	Fitted with two Head Light Projectors located ahead of the smoke box on the centre line of the boiler and equipped with swivelling *arrangement*, manually operated from the cab.
	Independent switches provided.
	Each projector of the concentrated-beam type fitted with a 250 watt 32 volt lamp (Stone's Tonum Head-light).

NOTE.—Distance from Driver's seat to front of engine, 43 feet.

OBSERVATIONS

With two Head-Lights, the visibility conditions generally show some improvement over those obtaining with one Head-Light.

I. STRAIGHTS

With Twin Head Lights :

(*i*) The visibility distance for a large-sized vertical object is of the order of 900 feet.

(*ii*) The visibility distance for rails to be fairly clearly seen is of the order of 300 feet.

NOTE.—At "summits" or "sags" the visibility is diminished for a short interval of time.

II. RIGHT-HAND CURVE ON LEVEL, ON BANK OR IN SHALLOW CUTTING :

(*a*) With Twin Head-Lights, swivelled into position and directed along the alignment, nearly the same conditions as stated under I above are obtained.

(*b*) With a Single Head-Light manipulated similarly, nearly the same conditions as stated in I (a) under Test No. 1 are obtained.

III. RIGHT-HAND CURVE IN MEDIUM OR DEEP CUTTING :

Where the cutting is wide on account of double or multiple tracks, nearly the same conditions as stated under II above are obtained. Where, however, the formation is for single line, the sides of the cutting govern the visibility-distance.

IV. LEFT-HAND CURVE ON LEVEL, ON BANK OR IN SHALLOW CUTTING :

From the Driver's seat, the visibility is practically nil. From the left side of the cab, the same conditions as stated under II above are obtained.

V. LEFT-HAND CURVE IN MEDIUM OR DEEP CUTTING :

From the Driver's seat, the visibility is practically nil. From the left side of the cab, the same conditions as stated under III above are obtained.

[No. 57TTV1/14.]

R. E. de Sa, Secy.

PRINTED IN INDIA BY THE GENERAL MANAGER, GOVT. OF INDIA PRESS, NEW DELHI AND PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI, 1958